



DEPARTMENT OF DEFENSE NUCLEAR/BIOLOGICAL/CHEMICAL (NBC) DEFENSE

ANNUAL REPORT TO CONGRESS FEBRUARY 1998



To order additional copies of this report, contact:

Defense Technical Information Center
Attn: DTIC-E (Electronic Document Project Officer)
8725 John J. Kingman Road, Suite 0944
Fort Belvoir, VA 22060-6218

or visit the DTIC web site for further information at:
<http://www.dtic.mil>

Cleared for public release.
Unlimited distribution.

TABLE OF CONTENTS

	Page
EXECUTIVE SUMMARY	<i>i</i>
INTRODUCTION	<i>xiii</i>
<u>CHAPTERS</u>	
1 CHEMICAL AND BIOLOGICAL DEFENSE PROGRAM	
MANAGEMENT AND OVERSIGHT	1-1
1.1 Management Implementation Efforts	1-3
1.1.1 Management Reviews	1-3
1.1.2 Coordination and Integration of the Program	1-3
1.2 Organizational Relationships	1-3
1.3 Technology Base Review and Assessment	1-6
1.4 DARPA Biological Warfare Defense Program Management	1-6
1.5 Funds Management	1-6
1.6 NBC Defense Program Management Assessment	1-8
2 NON-MEDICAL NBC WARFARE DEFENSE REQUIREMENTS	
AND R&D PROGRAM STATUS	2-1
2.1 Introduction	2-3
2.2 NBC Defense Mission Area Requirements and RDA Summary.....	2-4
2.3 Contamination Avoidance (Detection, Identification and Warning)	2-4
2.3.1 Contamination Avoidance Science and Technology Efforts	2-5
2.3.1.1 Goals and Timeframes	2-5
2.3.1.2 Potential Payoffs and Transition Opportunities.....	2-5
2.3.1.3 Major Technical Challenges	2-5
2.3.2 Contamination Avoidance Modernization Strategy.....	2-6
2.3.3 Joint Service Contamination Avoidance Programs	2-9
2.3.4 Warning and Reporting.....	2-10
2.3.5 Other Contamination Avoidance Programs	2-11
2.3.6 Defense Advanced Research Projects Agency (DARPA) Programs	2-11
2.4 Protection	2-11
2.4.1 Protection Science and Technology Efforts	2-12
2.4.1.1 Goals and Timeframes	2-12
2.4.1.2 Potential Payoffs and Transition Opportunities.....	2-12
2.4.1.3 Major Technical Challenges	2-13
2.4.2 Protection Modernization Strategy	2-13
2.4.3 Joint Service Protection Programs	2-16
2.4.4 Other Protection Programs	2-19
2.5 Decontamination	2-19
2.5.1 Decontamination Science and Technology Efforts.....	2-20
2.5.1.1 Goals and Timeframes	2-20
2.5.1.2 Potential Payoffs and Transition Opportunities.....	2-20
2.5.1.3 Major Technical Challenges	2-20
2.5.1.4 Chem War 2000.....	2-21
2.5.2 Decontamination Modernization Strategy	2-21
2.5.3 Joint Service Decontamination Programs	2-23

	Page
2.5.4 Other Decontamination Programs	2-23
2.6 Equipment for the Chemical/Biological Rapid Response Team	2-23
2.7 Non-Medical CB Defense Requirements Assessment.....	2-24
3 MEDICAL NBC WARFARE DEFENSE REQUIREMENTS AND R&D PROGRAM STATUS.....	3-1
3.1 Requirements	3-3
3.1.1 Introduction	3-3
3.1.2 Challenges in the Medical NBC Warfare Defense Programs.....	3-4
3.1.3 Reducing Reliance on Research Animals.....	3-6
3.1.4 Medical Program Organization	3-6
3.2 Medical Chemical Defense Research Program	3-7
3.2.1 Goals.....	3-7
3.2.2 Objectives.....	3-8
3.2.3 Threats, Countermeasures, Technical Barriers, Status, and Accomplishments	3-8
3.3 Medical Biological Defense Research Program.....	3-8
3.3.1 Goals.....	3-9
3.3.2 Objectives.....	3-9
3.3.3 Threats, Countermeasures, and Technical Barriers	3-10
3.3.4 DARPA Programs	3-12
3.4 Medical Nuclear (Radiological) Defense Research Program.....	3-13
3.4.1 Goals.....	3-13
3.4.2 Objectives.....	3-14
3.4.3 Threats, Countermeasures, Technical Barriers, and Accomplishments	3-14
3.5 Medical NBC Research Projection	3-17
3.6 Medical R&D Requirements Assessment.....	3-18
4 NBC WARFARE DEFENSE LOGISTICS STATUS	4-1
4.1 Introduction	4-3
4.2 NBC Defense Logistics Management	4-4
4.3 Quantities, Characteristics, and Capabilities	4-6
4.4 Logistics Status.....	4-7
4.5 Peacetime Requirement	4-10
4.6 Funding.....	4-11
4.7 Industrial Base	4-12
4.8 NBC Defense Logistics Support Assessment.....	4-13
Appendix 1: Breakout of Service War Requirements, Stocks On-Hand, and Planned Acquisitions	4-15
Appendix 2: Fielded NBC Defense Items – Issues and Concerns	4-30
1. Contamination Avoidance	4-30
2. Individual Protection.....	4-30
3. Collective Protection.....	4-33
4. Decontamination.....	4-34
5. Medical.....	4-35

	Page
5 NBC DEFENSE READINESS AND TRAINING	5-1
5.1 Introduction	5-3
5.2 Joint NBC Defense Doctrine	5-3
5.2.1 Joint NBC Defense Doctrine Program Management.....	5-3
5.2.2 Joint NBC Defense Doctrine Development Program	5-4
5.2.3 Army Medical Doctrine Development Program.....	5-4
5.2.4 Air Force Medical Doctrine Development Program.....	5-5
5.3 Standards/Proficiency and Currency	5-5
5.3.1 Army	5-5
5.3.2 Air Force	5-9
5.3.3 Navy.....	5-10
5.3.4 Marine Corps.....	5-10
5.4 NBC Defense Professional Training.....	5-12
5.4.1 Joint NBC Defense Professional Training.....	5-13
5.4.2 Army NBC Defense Professional Training	5-13
5.4.3 Air Force NBC Defense Professional Training	5-15
5.4.4 Navy NBC Defense Professional Training	5-15
5.4.5 Marine Corps NBC Defense Professional Training.....	5-16
5.5 Training in a Toxic Chemical Environment	5-17
5.6 Integration of Realism/Wargames/Exercises	5-18
5.6.1 Simulations and Wargames	5-18
5.6.2 Joint NBC Training/Joint and Combined Exercises.....	5-19
5.7 Initiatives	5-22
5.7.1 Joint	5-22
5.7.2 Army	5-23
5.7.3 Air Force	5-23
5.7.4 Navy.....	5-24
5.7.5 Marine Corps.....	5-24
5.7.6 Emergency Response: Army Medical Response	5-26
5.8 Readiness Reporting System.....	5-28
5.9 NBC Defense Training and Readiness Assessment.....	5-29
6 STATUS OF DOD EFFORTS TO IMPLEMENT THE	
CHEMICAL WEAPONS CONVENTION.....	6-1
6.0 Introduction	6-3
6.1 Department of Defense Preparations and Implementation	6-3
6.2 Training for Inspectors	6-4
6.3 Preparation of Defense Installations.....	6-4
6.4 Defense Treaty Inspection Readiness Program	6-5
6.5 Article X Assistance and Other Assistance.....	6-6
6.6 Verification Technology	6-6

ANNEXES

Page

A	Contamination Avoidance Programs	A-1
I.	Fielded and Production Items	A-3
II.	RDTE Items.....	A-12
B	Non-Medical Protection Programs	B-1
I.	Fielded and Production Items	B-3
II.	RDTE Items.....	B-15
C	Decontamination Programs	C-1
I.	Fielded and Production Items	C-3
II.	RDTE Items.....	C-6
D	Joint Medical Chemical and Biological Defense Research Programs	D-1
D.1	Medical Chemical Defense Research Program	D-3
D.2	Medical Biological Defense Research Program	D-13
D.3	Medical Nuclear (Radiological) Defense Research Program.....	D-27
E	Summary of FY96 RDT&E Funds for the CBD Program.....	E-1
F	Statement Regarding Chemical and Biological Defense Programs Involving Human Subjects	F-1
G	Congressional Reporting Requirement: 50 USC 1523	G-1
H	NBC Defense on the Internet	H-1
I	Acronyms and Abbreviations.....	I-1

TABLES AND FIGURES

TABLES	Page
2-1 Contamination Avoidance Science and Technology Strategy	2-5
2-2 Contamination Avoidance Modernization Strategy	2-6
2-3 Contamination Avoidance RDA Efforts.....	2-7
2-4 Protection Science and Technology Strategy	2-12
2-5 Protection Modernization Strategy	2-14
2-6 Protection RDA Efforts.....	2-15
2-7 Decontamination Science and Technology Strategy	2-20
2-8 Decontamination Modernization Strategy	2-22
2-9 Decontamination RDA Efforts	2-22
3-1 Medical Biological Defense Countermeasures and Diagnostic Techniques	3-13
3-2 Medical Nuclear Defense Countermeasures	3-15
3-3 Medical NBC Defense Programs and Modernization Strategy	3-17
4-1 Logistic Risk Assessments: 46 NBC Defense Items	4-9
4-2a Army Logistics Readiness Data - Nonconsumables.....	4-17
4-2b Army Logistics Readiness Data - Consumables.....	4-18
4-3a Air Force Logistics Readiness Data - Nonconsumables.....	4-20
4-3b Air Force Logistics Readiness Data - Consumables	4-21
4-4a Navy Logistics Readiness Data - Nonconsumables	4-23
4-4b Navy Logistics Readiness Data - Consumables	4-24
4-5a Marine Corps Logistics Readiness Data - Nonconsumables	4-26
4-5b Marine Corps Logistics Readiness Data - Consumables	4-27
4-6 Defense Logistics Agency Logistics Readiness Data - Consumables	4-29
 FIGURES	
1-1 Chemical and Biological Defense Program Management Structure	1-4
1-2 Chemical and Biological Defense Funds Management Process.....	1-7
2-1 Letter to Congress regarding M-40 Mask Issue	2-26
3-1 Standard FDA Approval Process for Biological Defense Medical Products.....	3-5
4-1 War Reserve Requirements and Planning.....	4-5
4-2 Fielded Chemical and Biological Defense Items Data Assessment.....	4-8
5-1 USMC Individual NBC Training	5-11
5-2 USMC Collective Training, NBC Requirements	5-12
5-3 USMC Individual Training (Enlisted NBC Specialists)	5-16
5-4 USMC Individual Training (Training for NBC Officers)	5-17
5-5 Chemical/Biological Incident Response Force (CBIRF) Role in Training	5-25

(INTENTIONALLY BLANK.)

INTRODUCTION

DEPARTMENT OF DEFENSE CHEMICAL AND BIOLOGICAL DEFENSE PROGRAM

ANNUAL REPORT TO CONGRESS

(INTENTIONALLY BLANK)

I. PURPOSE

This report provides Congress with an assessment of the overall readiness of the Armed Forces to fight in a nuclear, biological, and chemical (NBC) warfare environment in accordance with 50 USC 1523. This is the fifth report submitted under 50 USC 1523.*

The objective of the Department of Defense (DoD) NBC defense program is to enable our forces to survive, fight and win in NBC-contaminated environments. In addition to the continuing requirement to respond to two simultaneous Major Theater Wars, numerous rapidly changing factors influence the program and its management. These factors include a new defense strategy, an era of declining DoD resources to include force structure reductions, planning for warfighting support to regional threat contingencies, the effects of the breakup of the Soviet Union, the entry into force of the Chemical Weapons Convention (CWC), and continued proliferation of NBC weapons.

The President's 1997 report, *The National Security Strategy of Engagement and Enlargement*, emphasizes the three key elements of the executive branch's strategy as "(1) to enhance our security with effective diplomacy and with military forces that are ready to fight and win; (2) to bolster America's economic prosperity; (3) to promote democracy abroad." U.S. forces must have numerous capabilities in order to respond and deploy quickly to various worldwide needs. Counterproliferation capabilities are required by forces to meet worldwide needs, and NBC defense is integral to counterproliferation capabilities. The Commanders-in-Chief have identified their priorities for counterproliferation capabilities. These priorities are shown in Table I-1. NBC defense related items are highlighted in **bold**.

Table I-1. Required CINC Counterproliferation Capabilities

1. CP Intelligence Cycle
2. Conventional Response (Precision Munitions) with minimum collateral effects
3. SOF Response and Intel Collection/Analysis Targeting Covert/Paramilitary/Terrorist Threat
4. **Battlefield NBC Detection and Warning**
5. TMD with minimum collateral effects
6. Defeat underground targets
7. Target Planning/Analysis including Collateral Effects Prediction and Post-Strike Assessment
8. **Individual Protection**
9. Proliferation Pathway Analysis
10. CMD/Aircraft Defense with minimum collateral effects
11. **Collective Protection**
12. Mobile Target Defeat
13. Offensive Information Warfare
14. CP Consequence Logistics Capability
15. **Decontamination**
16. **NBC Medical Treatment**

The response to the threat of NBC weapons must be based on the nature of this threat, not just where the threat occurs. A key part of DoD's strategy is to stem the proliferation of

* The text of 50 USC 1523, *Annual report on chemical and biological warfare defense*, (implemented as part of Public Law 103-160, the FY94 National Defense Authorization Act) is included at Annex G.

such weapons and to develop an effective capability to deal with these threats. To focus the response to the threat, DoD and the intelligence community have completed several classified reports providing threat assessments on chemical and biological threats to U.S. forces. To minimize the effect of these threats to our forces, we need to demonstrate the capability to deter their use through continuing improvements in our NBC defensive capabilities. The DoD NBC defense program continues to work towards increasing the capabilities of Joint Forces to survive and continue their mission during conflicts which may involve the use of NBC weapons.

The number of nations with CBW capabilities is increasing. Similarly, the sophistication of CBW capabilities is increasing. Proliferation of weapons technology, precision navigation technology, nuclear (medical, power, and industrial applications), and CBW technology to developing nations presents the United States with a complicated national security challenge. Intelligence efforts include collection and analysis of nations' "dual-use" nuclear, chemical and biological industrial capabilities and develop the indications and warning of adversarial use of dual-use capabilities. Tailored intelligence documents are essential for developing and updating requirements for CB defense programs. Numerous threat documents tailored to the CB threat have been produced and are updated periodically. The Intelligence Community continues to review U.S. chemical and biological warfare intelligence requirements and assess the adequacy of those assets to execute the required intelligence program.

The DoD NBC defense program invests in technologies to provide improved capabilities that have minimal adverse impact on our war fighting potential. Our goals are to provide:

- improved capabilities to detect NBC agents in order to avoid their effects;
- lighter, less burdensome protection;
- decontamination systems with reduced logistical burden;
- decontaminants that are less toxic and environmentally safe;
- integrated, balanced system of force protection; and
- medical casualty care and management.

All of the capabilities integrated together as a system-of-systems are essential to avoid contamination and to sustain operational tempo on an asymmetric battlefield. Sound Joint doctrine and realistic training remain fundamental to our defense against NBC weapons.

II. THREAT ASSESSMENT

Nuclear Weapons Threat: The threat posed to the United States and its allies by the proliferation of nuclear weapons is real and growing. While there is no current, direct Inter-Continental Ballistic Missile (ICBM) threat against the United States by nations other than Russia and China, the threat from theater ballistic missiles is of growing concern. More than two dozen countries have operational ballistic missiles, and more have programs in place to develop them. North Korea has sold Syria and Iran extended-range Scud Cs and has apparently agreed to sell missiles to Libya. Egypt, Israel, and Pakistan are developing and producing missiles, and several Persian Gulf states have purchased whole systems as well as production technology from China and

North Korea. Some have equipped these missiles with NBC warheads, and others are striving to do so.

North Korea has developed and tested an indigenous ballistic missile with a range of about 1,000 kilometers. This missile is capable of carrying the full range of NBC weapons. North Korea's continued efforts to sell the missile abroad—particularly to dangerous and potentially hostile countries such as Iran—is of greatest concern. With this missile, North Korea could reach Japan; Iran could reach Israel, and Libya could reach US bases and allied capitals in the Mediterranean region.

Two countries that could engage in warfare using nuclear weapons are India and Pakistan. Both nations have nuclear weapon development programs. In other areas such as the Mid-East and Far-East there is the potential for similar activity. The nuclear threat posed by North Korea is of major concern not only to South Korea and Japan but also to China. As long as nations perceive nuclear weapons as enhancing their security, and others are willing to sell the technology, required production equipment, or finished weapons, the threat from nuclear proliferation will grow.

Chemical and Biological Weapons (CBW) Threat

Despite the end of the Cold War, the United States still faces serious national security issues. At the forefront of these issues are the proliferation of CBW and related technologies and the desire of numerous Third World countries to acquire a chemical and/or biological warfare capability to augment their conventional military arsenals. Moreover, of the nations currently believed to have active CBW efforts underway, a majority also have parallel programs to develop ballistic missiles as a possible means for agent delivery.

Protecting against CBW attacks can make it difficult to carry out military missions because protective measures restrict vision and mobility, add weight, and increase heat stress. Further, logistic burdens are added by the need for decontamination chemicals and equipment, detection gear, and specialized reconnaissance devices and vehicles. Threatened or actual use of CBW places significant stress on troop morale.

Many of the future scenarios for CBW use are not expected to differ from those envisioned historically. However, because U.S. forces have fewer assets pre-positioned in areas of potential conflict, those assets associated with power projection into those theaters such as ports, airfields and logistical depots are the subject of increased attention. Infectious agents may be most effective against the first category (I) from the following list of targets, since these agents have a relatively slow onset of effect but larger area coverage. A wide variety of CB agents may be employed against targets in the second and third categories. Chemical and toxin agents may be most effective against targets in the fourth category (IV) from the following list of targets, since these agents have a relatively rapid onset of effect but smaller area coverage per unit weight of agent than infectious agents.

- I. High-value, large-area facilities/targets within or outside of theater: leadership, diplomatic, military headquarters, industrial, commercial, population centers.
- II. Theater support military facilities: command and control, troop barracks, air bases, missile launch sites, naval ports, logistical transfer/storage facilities.
- III. Military assets near engagement areas: troop convoys, staging areas, drop zones, air strips, air defense systems, artillery support bases, naval task forces.
- IV. Forces in engagement: infantry, amphibious, mechanized/armor.

CBW known to have been designed in conjunction with offensive programs have taken a wide variety of forms. Probable means of weapons employment for optimal agent effect are summarized below.

- *Off-target (upwind) attacks using agent aerosol disseminators moved along paths perpendicular to wind direction.* Means of delivery could include aircraft, UAVs, cruise missiles, boats/submersibles, or ground vehicles. Such attacks also could be achieved with multiple source detonation/spray devices covertly emplaced upwind from the target or employed by SOF or triggered remotely or by timing devices.
- *On-target attacks using various forms of agent containing fused munitions that explosively disseminate or spray agent at or near ground level.* Among these munitions are ballistic and cruise missile warheads, aircraft ordnance, tube and rocket artillery, and naval gunfire.
- *Area-denial attack using persistent (generally chemical) agents laid down in a heavy pattern with the intention of contaminating ground areas and water-crossing points that enemy forces may attempt to traverse.* Means of delivery could include aircraft ordnance, artillery, and mines.

CBW aimed at certain critical nodes in the military infrastructure of the United States—either domestically or abroad—could disrupt the execution of military objectives. Therefore, it is imperative that the United States have an ability to operate effectively in a contaminated environment while simultaneously being able to identify threat agents, treat injured personnel, and remediate the contaminated area.

Another less well defined threat in the realm of chemical warfare or terrorism is the potential for a Bhopal-like event resulting from deliberate targeting of industry or commerce in population centers. A current example of this situation may be found in the operations in Bosnia. Chemical plants in Bosnia are designed to produce large quantities of chemicals for the manufacture of common products, such as plastics. During WWI, some of these chemicals were used as warfare agents. These chemicals, such as phosgene and chlorine, have become staples of the modern chemical industry; yet their potential for use during conflict is as great today as ever. Moreover, the political situation and the restraints on the use of such chemicals as weapons, restraints which have precluded their use in warfare among the industrialized nations over the past 80 years, may no longer exist in these regions of ethnic and religious conflict.

U.S. forces that have to operate in these regions face, therefore, the combined threats of both historical chemical agents and weapons and the potential for exposure to chemicals produced as an

element of the regions chemical industry. Scale of operation is the main discriminator between military uses of weapons and chemicals released from chemical plants by saboteurs or collateral damage resulting from military operations. The chemical plant at Tuzla is a prime example. The chemical storage tanks there have a capacity to hold more than twice as much chlorine as was released by Germany in their first ever chemical attack, which killed or injured over 5,000 people in a span of 15 minutes. If released in an area like Tuzla, such a catastrophic release could have a significant effect on military operations, as well as affecting future humanitarian, political, and economic considerations locally and internationally.

The Regional Chemical and Biological Warfare Threat

Northeast Asia

North Korea has pursued research and development related to biological warfare since the 1960s. Pyongyang's resources presently include a rudimentary (by Western standards) biotechnology infrastructure, which is sufficient to support the production of limited quantities of toxins, viral, and bacterial biological warfare agents. In the early 1990s, an open press release by a foreign government further pointed to applied military biotechnology work at numerous North Korean medical institutes and universities dealing with the anthrax, cholera, plague, and smallpox pathogens. This press release also mentioned the testing of unspecified biological warfare agents on North Korean island territories.

By comparison, North Korea is believed to have a more robust chemical warfare effort, which includes the capability since 1989 to independently produce bulk quantities of both chemical agents and munitions. Since that period, this program has matured to now include a sizable stockpile of chemical weapons and the capability to manufacture nerve, blister, choking and blood agents. North Korea has also devoted considerable scarce resources to defensive measures aimed at protecting its civilian population and military forces from the effects of chemical weapons. Such measures include extensive training in the use of protective masks, suits, detectors, and decontamination systems. Though these measures are ostensibly focused on a perceived threat from U.S. and South Korean forces, they could also support the offensive use of chemical weapons by the North during combat. North Korea has yet to sign the Chemical Weapons Convention (CWC) and is not expected to do so in the near-term because of the intrusive inspection and verification requirements mandated by the agreement.

China possesses an advanced biotechnology infrastructure and requisite biocontainment facilities necessary to perform research and development on lethal pathogens. Although China has consistently claimed that it has never researched or produced biological weapons, it is nonetheless believed to likely retain a biological warfare capability begun before acceding to the Biological Weapons Convention (BWC).

China is believed to have an advanced chemical warfare capability that includes not only a research and development program, but also production and weaponization capabilities. Its current inventory includes the full range of traditional agents and may, in the future, include more advanced chemical agent compounds. It has a wide variety of delivery systems for

chemical agents, including artillery rockets, aerial bombs, sprayers, and short-range ballistic missiles. Chinese forces, like those of North Korea, have conducted defensive CW training and are prepared to operate in a contaminated environment. As China's program is further integrated into overall military operations, its doctrine, which is believed to be based in part on Soviet-era thinking, may reflect the incorporation of more advanced munitions for CW agent delivery.

South Asia

India has a well-developed biotechnology infrastructure which includes numerous pharmaceutical production facilities and secure biocontainment laboratories for working with lethal pathogens. It also has qualified scientists with experience in infectious diseases. At least some of India's facilities are being used to support research and development for biological defense work. India has ratified the BWC of 1972

India has an advanced commercial chemical industry and infrastructure. It produces the bulk of its own chemicals for domestic consumption. After New Delhi ratified the CWC in 1996, it subsequently acknowledged the existence of a chemical warfare program and indicated that all facilities related to this program will be open for inspection. India is believed to have numerous munitions and delivery vehicles that could be used to deliver CW agents, including artillery, aerial bombs, and missiles.

Pakistan has a capable but less well-developed biotechnology infrastructure than India. Its facilities, while fewer in number, could nonetheless support work on hazardous biological pathogens. Moreover, Pakistan is believed to have the resources and capabilities necessary to support a limited biological warfare research and development effort. Like India, Pakistan has ratified the BWC.

Pakistan has a less-well developed commercial chemical industry but is expected to eventually have the capability to produce all precursor chemicals needed to support a chemical weapons stockpile. Like India, Pakistan has numerous munitions delivery vehicles that could be used to deliver CW agent, including artillery, aerial bombs, and missiles. Pakistan has ratified the CWC.

The Middle East and North Africa

Iran's biological warfare program, which began during the Iran-Iraq War, is generally believed to be in the research and development phase. Iran has qualified, highly-trained scientists and considerable expertise with pharmaceuticals. It also possesses the commercial and military infrastructure needed to produce basic biological warfare agents and may have produced pilot quantities of usable agent. Although Iran is a signatory to the BWC, this agreement does not now contain on-site inspection protocols to verify compliance.

Although Iran had a chemical weapons program underway early in the Iran-Iraq War, it has, since the early 1990s, placed a high priority on furthering this effort, to include expanding both the chemical production infrastructure and munitions arsenal. Iran currently manufactures

weapons for blister, blood, and choking agents and is believed to be conducting research on nerve agents. It has the capability to deliver CW agents using artillery shells and aerial bombs. Iran has ratified the CWC.

Prior to the Gulf War, Iraq developed the largest and most advanced biological warfare program in the Middle East. Though a variety of agents were studied, Iraq actually declared anthrax, botulinum toxin and aflatoxin to have completed the weaponization cycle. During the Gulf War, coalition bombing destroyed or damaged many key facilities associated with BW activity. However, it is suspected that a key portion of Iraq's BW capability, in the form of agent-filled munitions, was hidden and may have subsequently escaped damage. Nonetheless, Iraq declared after the war that all BW agent stockpile and munitions were unilaterally destroyed. UNSCOM activity has, however, revealed this assertion as well as many others related to BW activity to be inaccurate and misleading. As with its chemical program, there are indications that Iraq intends to re-establish its BW capabilities if afforded the opportunity by the relaxation or cessation of UNSCOM inspection activity.

Iraq had a mature chemical weapons program prior to the Gulf War, which included a variety of nerve agents, including tabun and sarin, as well as the blister agent mustard, available for offensive use. Iraq also undertook a program, begun in 1985, to develop the nerve agent VX. This activity continued uninterrupted until December 1990. Although Iraq's chemical warfare program suffered extensive damage during the Gulf War and subsequently from UNSCOM activity, Iraq retains a limited capability to reconstitute key parts of its chemical warfare program. Information released from Hussein Kamel, a senior Iraqi defector, revealed that Iraq had hidden from UN inspectors sophisticated chemical warfare capabilities heretofore unknown. These included a program to develop binary sarin-filled artillery rounds, as well as rockets and aerial bombs in quantities beyond the prototype level. Also revealed was a precursor production capability sufficient to produce 400 tons of VX per year. The comprehensive nature of Iraq's previous chemical warfare activity and the consistent pattern of denial and deception employed by Iraqi authorities indicate an intent to rebuild this capability, should Iraq be given the opportunity.

Syria has an adequate biotechnology infrastructure which could support a limited biological warfare effort. Though Syria is believed to be pursuing the development of biological weapons, it is not believed to have progressed much beyond the research and development phase and may have produced only pilot quantities of usable agent. Syria has signed the BWC.

Syria has a mature chemical weapons program, begun in the 1970s, incorporating nerve agents, such as sarin, which have completed the weaponization cycle. Future activity will likely focus on CW infrastructure enhancements for agent production and storage as well as possible research and development on advanced nerve agents. Munitions available for CW agent delivery likely include aerial bombs as well as SCUD missile warheads. Syria has not signed the CWC.

Libya's biological warfare program is believed to remain in the early research and development phase. Progress has been slow due in part to an inadequate scientific and technical base. Though Libya may be able to produce small quantities of usable agent, it is unlikely to

transition from laboratory work to production of militarily significant quantities until well after the year 2000. Libya acceded to the BWC in 1982.

Libya retains a chemical warfare production capability even though efforts to develop CW agents were stymied, in part, by the intense public scrutiny afforded to its Rabta facility in the late 1980s. Prior to this time, however, Libya succeeded in producing up to 100 tons of blister and nerve agent at the site. Although Rabta was closed in 1990, it subsequently re-opened in 1995 ostensibly as a pharmaceutical plant, though the facility is still believed capable of producing CW agents. Libya is not a signatory to the CWC.

Independent States of the Former Soviet Union

The former Soviet offensive biological warfare program was the world's largest and consisted of both military facilities and non-military research and development institutes. Non-military activity was centrally coordinated and performed largely through a consortium of institutes known as Biopreparat. This network of facilities was created in 1973 as a cover for activity related to biological warfare. This huge organization at one time employed up to 25,000 people and involved nearly 20 research, development and production facilities. The Russian government has committed to ending the former Soviet BW program, although serious questions about offensive BW capabilities remain. Key components of the former program remain largely intact and may support a possible future mobilization capability for the production of biological warfare agents and delivery systems. Moreover, work outside the scope of legitimate biological defense activity may be occurring at selected facilities within Russia. Such activity, if offensive in nature, would contravene the BWC of 1972, to which the former Soviet government is a party. It would also contradict statements by top Russian political leaders that offensive activity has ceased.

While former Soviet biological warfare facilities existed in Ukraine, Kazakhstan, and Uzbekistan, none are currently active. Moreover, the governments in these new republics are not believed to have plans to establish any future BW capability. Also, Belarus has no program and no intention of establishing one. Ukraine, Belarus, and Uzbekistan have ratified the BWC, while Kazakhstan has not yet signed it.

Russia has acknowledged the world's largest stockpile of chemical agents, amounting to approximately 40,000 metric tons. This stockpile, consisting mostly of weaponized agent, includes artillery, aerial bombs, rockets, and missile warhead munitions. Actual agents include a variety of nerve and blister agents. Additionally, some Russian chemical weapons incorporate agent mixtures, while others have added thickening agents to increase agent persistence. Russian officials do not deny that CW research has continued but claim that it is for defensive purposes and therefore not proscribed by the CWC. Many of the components for new binary agents developed under the former-Soviet program have legitimate civilian applications and are not on the CWC's schedule of chemicals.

Although remnants of the former Soviet chemical program remain in Ukraine, the country has signed the CWC and has no chemical warfare program. Kazakhstan also inherited

facilities from the former Soviet program, though these have been demilitarized and are being converted to peaceful purposes. Uzbekistan inherited a former Soviet chemical test range, which has since been abandoned. Both Kazakhstan and Ukraine have signed but not ratified the CWC. Uzbekistan has ratified the treaty.

Proliferation

U.S. forces face a number of regional proliferation challenges. Iran continues with a concerted effort to acquire an independent production capability for all aspects of its chemical weapons program. Nonetheless, for the time being, it remains dependent on foreign sources for many chemical warfare-related technologies. China, as a key supplier of technologies and equipment for Iran's chemical warfare program, will play a pivotal role in determining whether Iran attains its long term goal of independent production for these weapons.

Proliferation of CBW technology in South Asia also raises several important issues. India has exported a wide array of chemical products, including Australia Group-controlled items, to numerous countries of proliferation concern in the Middle East. The controlled items include specific chemical agent precursors, pathogens with biological warfare applications, and dual-use equipment which can be used in both chemical and biological warfare programs. Pakistan, on the other hand, may be seeking to upgrade key parts of its biotechnology infrastructure with dual-use equipment and expertise. Such acquisition efforts would reflect Pakistan's less-well developed biotechnology infrastructure.

The proliferation of CBW-related technology remains a critical threat to peace and stability throughout the world. One mechanism through which industrialized countries have agreed to control the proliferation of key chemical and biological warfare-related technologies is the Australia Group. The Australia Group (AG) is a consortium of countries organized to slow the proliferation of chemical and biological warfare programs through the imposition of multilateral export controls. Initial efforts of this group began in June 1985 and focused on precursor chemicals used in the manufacture of chemical agents. However, convinced of the threat posed from biological weapons, AG countries subsequently agreed in December 1992 to also control the sale of items that most likely could be used to develop biological agents and weaponry. The AG adopted a list of human pathogens consisting of 37 organisms, 10 toxins and associated genetically-modified organisms, and a seven-item BW dual-use equipment list. In addition, the AG later adopted animal and plant pathogen lists in recognition of the threat posed from anti-crop and anti-animal biological warfare.

In North Africa, Libyan efforts to acquire foreign equipment and expertise related to biological warfare have been dealt a severe blow, largely because of UN sanctions. Due to the international community's encompassing restrictions on exports to Libya, efforts to proceed beyond laboratory-scale research and development related to biological warfare will be difficult.

(INTENTIONALLY BLANK.)